Co-axial piezoelectric sensors for e-textiles applications

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This work reports on the development of piezoelectric filaments for flexible sensors produced at high production rates, adequate for the industrial scale.
The integration of systems and devices into textile products is an increasingly interesting field which still offers large challenges. This integration often requires separate industrial processes for the textile and the device. Preferably, functional fibres providing a more significant part or even the complete solution for a given application should be used. Poly(vinylidene fluoride) (PVDF) is the polymer with the best piezoelectric performance. PVDF-based sensors are available on the market in the form of films. Some research work has targeted the development of PVDF sensors in filament/cable form. The filament-shaped piezoelectric sensor for textile applications should be arranged in a coaxial manner, comprising also conductive layer for signal acquisition.
Whereas the production of the piezoelectric layer has been successfully achieved [1], the use of conductive polymer composites for creation of the inner and outer electrodes is still under study [2]. In this work, two and three-layer filaments incorporating electrically conductive layers as electrodes and a piezoelectric layer, in a coaxial arrangement, are produced using conventional polymer extrusion equipment.
The production methodology involves a conventional coextrusion line, for which a coextrusion die was designed to produce a multilayer filament. Whereas the processing conditions of the piezoelectric filament are well established, large challenges remain for the conductive inner and outer carbon-based polymer composite. The obtained results and performance of the composite layer and the overall fibre sensor, ideal characteristics and challenges will be discussed

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